



Department of anesthesia techniques

Title of the lecture: lipid

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Lipid

Lipids: - are defined as compounds which are relatively insoluble in water, but freely soluble in non-polar organic solvent like benzene, chloroform, ether, hot alcohol, acetone, etc.

The lipids are a heterogeneous group of compounds, including fats, oils, steroids, waxes, and related compounds.

Functions of lipids:-

1-They are important dietary constituents because of their high energy. The caloric value is 9Kcal/gm as compared to carbohydrates which have the caloric value of 4 Kcal/gm.

2-Structural components of biomembranes (phospholipids and cholesterol).

3-As protective coating on the surface of many organs such as kidney, against injury.

4-Facilitation of the absorption of the fat soluble vitamins A, D, E and K.

5-Providing insulation against changes in external temperature (subcutaneous fat).

6-Metabolic regulators (steroid hormone and prostaglandins).

7-As transport forms of various metabolic fuel.

8-Acting as electric insulator in neurons.

Classification of Lipids

1-Simple lipids: Esters of fatty acids with various alcohols.

a. **Fats:** Esters of fatty acids with glycerol. **Oils** are fats in the liquid state.

b. **Waxes:** Esters of fatty acids with higher molecular weight monohydric alcohols.

2-Complex lipids: Esters of fatty acids containing groups in addition to an alcohol and a fatty acid.

a. **Phospholipids:** Lipids containing, in addition to fatty acids and an alcohol, a phosphoric acid residue. They frequently have nitrogen-containing

bases and other substituents, eg, in **glycerophospholipids** the alcohol is glycerol and in **sphingophospholipids** the alcohol is sphingosine.

b. **Glycolipids (glycosphingolipids):** Lipids containing a fatty acid, sphingosine, and carbohydrate.

c. **Other complex lipids:** Lipids such as sulfolipids and aminolipids. Lipoproteins may also be placed in this category.

3. Precursor and derived lipids: These include fatty acids, glycerol, steroids, other alcohols, fatty aldehydes, and ketone bodies, hydrocarbons, lipid-soluble vitamins, and hormones. Because they are uncharged, acylglycerols (glycerides), cholesterol, and cholesteryl esters are termed **neutral lipids**.

Fatty acids:- are the major unit of lipids. They are generally found in ester linkage in different classes of lipids.

Fatty acids are represented by the general formula $R-COOH$.

Numbers of carbon atoms of fatty acids are even or odd number, but odd number fatty acids are very rare.

Fatty acids may be saturated or unsaturated. Fatty acids that have double bonds are said to be *unsaturated*. If they have more than one double bond but no more than four they are commonly referred to as polyunsaturated fatty acids. Fatty acids that contain only single bond are called *saturated fatty acids*.

(saturated fatty acids)

Common Name	Number of C Atoms	
Acetic	2	Major end product of carbohydrate fermentation by rumen organisms ¹
Propionic	3	An end product of carbohydrate fermentation by rumen organisms ¹
Butyric	4	In certain fats in small amounts (especially butter). An end product of carbohydrate fermentation by rumen organisms ¹
Valeric	5	
Caproic	6	
Lauric	12	Spermaceti, cinnamon, palm kernel, coconut oils, laurels, butter
Myristic	14	Nutmeg, palm kernel, coconut oils, myrtles, butter
Palmitic	16	Common in all animal and plant fats
Stearic	18	

Number of C Atoms and Number and Position of Double Bonds	Family	Common Name	Systematic Name	Occurrence
Monoenoic acids (one double bond)				
16:1;9	ω 7	Palmitoleic	<i>cis</i> -9-Hexadecenoic	In nearly all fats.
18:1;9	ω 9	Oleic	<i>cis</i> -9-Octadecenoic	Possibly the most common fatty acid in natural fats.
18:1;9	ω 9	Elaidic	<i>trans</i> -9-Octadecenoic	Hydrogenated and ruminant fats.
Dienoic acids (two double bonds)				
18:2;9,12	ω 6	Linoleic	all- <i>cis</i> -9,12-Octadecadienoic	Corn, peanut, cottonseed, soybean, and many plant oils.
Trienoic acids (three double bonds)				
18:3;6,9,12	ω 6	γ -Linolenic	all- <i>cis</i> -6,9,12-Octadecatrienoic	Some plants, eg, oil of evening primrose, borage oil; minor fatty acid in animals.
18:3;9,12,15	ω 3	α -Linolenic	all- <i>cis</i> -9,12,15-Octadecatrienoic	Frequently found with linoleic acid but particularly in linseed oil.
Tetraenoic acids (four double bonds)				
20:4;5,8,11,14	ω 6	Arachidonic	all- <i>cis</i> -5,8,11,14-Eicosatetraenoic	Found in animal fats and in peanut oil; important component of phospholipids in animals.
Pentaenoic acids (five double bonds)				
20:5;5,8,11,14,17	ω 3	Timnodonic	all- <i>cis</i> -5,8,11,14,17-Eicosapentaenoic	Important component of fish oils, eg, cod liver, mackerel, menhaden, salmon oils.
Hexaenoic acids (six double bonds)				
22:6;4,7,10,13,16,19	ω 3	Cervonic	all- <i>cis</i> -4,7,10,13,16,19-Docosahexaenoic	Fish oils, phospholipids in brain.

The most common among the saturated fatty acids are palmitic acid (C_{16}), stearic acid (C_{18}) and among the unsaturated fatty acid, oleic acid (C_{18}). Fatty acids with one to eight carbons are liquids at room temperature while those with more carbon atoms are solids.

Most plant fats are liquid since they contain a large proportion of unsaturated fatty acids. Animal fats, on the other hand, contain a high proportion of palmitic and stearic acids, and are solid or semi

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